Acta Parasitologica Globalis 8 (1): 17-25, 2017
ISSN 2079-2018

DOI: 10.5829/idosi.apg.2017.17.25

A Study on the Prevalence of the Major Endo and Ectoparasites of Oxen in and Around Debre Zeit Twon

[1]Birhanu Eticha and [2]Haimanot Disassa

[1]Benishngul Gumuz Regional State,
Livestock and Fisheries Resource Development Agency, P.O. Box: 30 Assosa, Ethiopia
[2]Department of Veterinary Science, College of Agriculture and Natural Resources,
Assosa University, P.O. Box: 18 Assosa, Ethiopia

Abstract: This study was conducted from October 2008 to February 2009 in and around Debre Zeit town to determine the prevalence of the major endo/ectoparasites that affect oxen and to recommend the possible control measures. Faecal examination was made on 308 oxen and the prevalence of endoparasites was found to be 42.9%. The endoparasites identified were *Strongyle* spp (26.6%), *Eimeria* spp (9.7%), *Fasciola* spp (5.2%), *Paramphistomum* spp (0.6%) and *Schistosoma* spp (0.6%). Out of 120 oxen infected with gut parasites, 10% showed mixed infection with strongyle and *Eimeria* spp. The prevalence of both strongyle and *Eimeria* spp were highly variable between the two age groups of host animals with higher prevalence being in age group of 3-5 years than those of age group 5-10 years ($P<0.05$) while trematode infection did not show any significant difference ($P > 0.05$) in their occurrence between age groups of host animals. The monthly occurrence of different endoparasites in oxen of the study area revealed significant ($P < 0.05$) difference between months in occurrence of strongyle, *Eimeria* and *Fasciola* spp where as *Paramphistomum* and Schistosoma spp did not show to have any monthly effect ($P > 0.05$). Ectoparasites identified in the study site were ticks, mites and lice with prevalence of 68.5%, 14.6% and 8.8%, respectively. The monthly occurrence of different ectoparasites in oxen revealed significant ($P < 0.05$) difference between months in occurrence of ticks and mites whereas lice did not show to have any effect on months of their occurrence ($P > 0.05$). Ticks were identified to the genus level and the identified tick genera were *Rhipicephalus* (57.8%),Amblyomma (18.2%) and Hyalomma (16.2%). The most common mite spp identified was *Psoroptes ovis* (93.3%) followed by *Demodex bovis* (6.7%) that were 13.6% and 0.97% of the total animals examined. Two lice species, *Linognathus vituli* (96.4%) and *Haematopinus quaderipertusus* (3.6%) were identified. Out of the total oxen examined, 46.4% were found to have mixed infection/infestation with two or more of the parasites. To finalize, the finding of this study revealed moderately high prevalence of endoparasites and high prevalence of ectoparasite infestation of oxen implying the importance of devising strategic control measures to mitigate the parasitic adverse effect on livestock production and health status in the study area.

Key words: Oxen · Debere Zeit · Ectoparasite · Endoparasite

INTRODUCTION

Ethiopia is one of the richest countries in livestock population. Central statistical Authority [1] report shows that the country has about 41 million heads of cattle, which is highest in Africa. This sector of production is a determinant component for the overall farming systems serving as a source of draft power for the majority of rural population besides supplying products (Millk and meat), by-products (Manure, skin and hides) and cash income from the sale of livestock and their products [2, 3].

Like all other developing countries, Ethiopia depends on its natural resources for its economic stability and further advancement. The agriculture sector forms the backbone of the national economy. Agriculture generates about 80% of exports and employees over 80% of the total labour forces [4].

Corresponding Author: Birhanu Eticha, Benishngul Gumuz Regional State, Livestock and Fisheries Resource Development Agency, P.O. Box: 30 Assosa, Ethiopia. E-mail: Brihanueticha12@gmail.com.

The majority of farmers in sub-Saharan Africa including Ethiopia practice small-scale mixed farming on areas of less than four hectares. For these people draft animal power offers a feasible alternative power source in cultivation of food and cash crops. Animal power was introduced in to the sub-Saharan Africa over the last century and its use has been increasing in recent years [5]. However, manual labour still predominates.

Each of the arid, semi-aird and sub-humid Zones was reported to be the home for 14% of oxen populations. The majority of cattle populations (52%) were found in the highlands of Ethiopia where 43.6% of human agricultural population was residing which indicated that cattle had a very important role in Ethiopian economy [6].

According to Schwartz and Doli [7] the use and management of draft oxen in Ethiopia was merely of traditional and probably was the least exploited. Although the country had huge number of oxen for draught power, it did not benefit from these resources towards ensuring self-sufficiency to the steadily growing population. The prevailing poor management, nutrition and diseases (Parasitic, bacterial, viral, fungal etc) were some of the factors responsible for the poor performance and inefficient utilization of these resources.

Parasitic diseases of production animals are distributed in the world. The effects of parasitisim can be separated in two categories: sub-clinical (Asymptomatic) and clinical (Symptomatic). The sub-clinical effects include losses in animal productivity such as mild production, reduced weight gain, altered carcass composition and conception rate, where as visible disease symptoms like diarrhea, anemia, associated edema and roughness of coat are clinical effects [8, 9].

The effect of endoparasites on oxen varies with the severity of infection as well as age and stress level of animals. Young hosts are highly susceptible to parasites during their first exposure to pasture [10, 11]. The endoparasites known to cause diseases in oxen can be grouped as helminthes and protozoa [12].

There is no adequate information regarding the prevalence and economic significance of endoparasites (Helminthes and protozoa) in oxen in the country. The economic assessment of impact of parasites on performance of livestock is based on the prevalence of such diseases. A preliminary survey by Graber [13] has indicated the presence of several types of endoparasites in various parts of the country. Some of the attempts made in Ethiopia to study helminth parasites of cattle most focusing on adult include Ademe [14] in south Wollo, Zerfu [15] in Asella, Tesfaye [16] in Kelala and Etsehiwot [17] in Holetta.

The existences of various ectoparasites affecting cattle are frequently reported from different parts of Ethiopia that consists of ticks, demodectic, sarcoptic and psoroptic manges and lice.

Ticks, besides being important vector for diseases, also cause non-specific disease symptoms like anemia, dermatitis, toxicosis and paralysis [18].

In Debre Zeit town and its surrounding a large number of oxen are brought to Faculty of veterinary medicine/Addis Ababa University/ open air clinic for the purpose of treatment against different types of disease from different ecological and management systems. Therefore, the objectives of this study were to determine the prevalence of the major endo-and ectoparasites that affect oxen in Debre Zeit town and its surroundings and to suggest possible control measures against these parasites.

MATERIALS AND METHODS

Study Area and Study Period: The study was conducted in Debre Zeit town and its surrounding rural areas of East Shoa district, south of Ethiopia during the period from October 2008 to February 2009. Debre Zeit is located 45 Km south east of Addis Ababa. The area is located 9°N latitude and 4° E longitudes at an altitude of 1850 meter above sea level in the centeral highlands of Ethiopia. It has an annual rainfall of 866 mm of which 84% is in the long rainy season (June to September). The dry season extends from October to February. The mean annual maximum and minimum temperature were 26°C and 14°C, respectively, with mean relative humidity of 61.3% [19].

Farmers in the vicinity of Debre Zeit town and its surrounding rural areas follow mixed Crop livestock farming system. Debre Zeit and its surroundings (Within 50 km of radius) have variable agro-ecologies. These varying Agro-climatic Zones are inhabited with different plant and animal species [20].

Study Animals and Management: The study was conducted on a total of 308 clinically sick oxen that were brought to the faculty of veterinary medicine /Addis Ababa University / open air clinic from Debre Zeit town and its surroundings. The study target was oxen of 3-10 years of age group that were brought to the clinic because of any health problem from extensive management system and all oxen within the age group that were brought to the clinic during the study period were sampled for the study purpose.

Study Design: The study was conducted purposely to determine the prevalence of the major endo-and ectoparasites that affect oxen during the study period in the study area.

Faecal Sample Collection: Faecal samples were collected from the study animals directly from the rectum and/or top layer of fresh voided faeces in to labeled plastic container. After collection the samples were transported to faculty of veterinary medicine (Addis Ababa University) arasitology laboratory for investigation. The samples were stored in a refrigerator at +4°C until examination. While collecting samples age of the animal were recorded. The ages of the animals were determined based on dental table (Incisors) [21].

Examination of the Skin for Ectoparasites: The skin of the oxen was inspected for the presence of parasites or skin lesions. Any visible ectoparasites were collected and skin scraping was made when suspected mange lesions were encountered using the procedure described by Urquhart *et al*. [22].

Corpological Examination: Faecal samples were processed and examined by simple flotation, sedimentation and Baermann technique for some of the oxen having history of respiratory signs. The flotation fluid used in the study was NaCl, prepared in the laboratory. The procedures of Sloss *et al*. [23] were followed for the above three methods. Eggs of parasites were identified using identification keys [24].

Data Analaysis: Descriptive statistics was used to summarize the generated data on the prevalence of both endo-and ectoparasites. The effect of age on the occurrence of the parasites was assessed by using persons chi-square(χ^2) test. A confidence interval of 95% was used to interpret the statistical associations and significance was considered when P-value was less than 0.05 [25].

RESULTS

Out of the total 308 fecal samples examined 120 (38.9%) were found to harbor either helminth ova or oocysts of coccidia. Four types of helminth ova were identified along with oocysts of a single coccidian. The species identified and their frequencies are shown in Table 1.

The monthly occurrence of different endoparasites in oxen revealed significant ($p < 0.05$) difference between months in occurrence of strongyle, *Eimeria* and *Fasciola* spp where as *Paramphistomum* and *Schistosoma* spp did not show to have any monthly effect ($P > 0.05$) (Table 2).

Infection with *Strongyle* and *Emeria* spp were found to have association with the age of host animal ($P<0.05$), the younger animals (3-5 years) being more infected. The other three species did not show any association with the age of host animals ($P>0.05$) (Table3).

Examination for ectoparasite infestation in the study area revealed that 283 animals were infested (91.9%) out of 308 oxen examined. The major ectoparasites identified in the study area include ticks, mites and lice with prevalence of 68.5% (211), 14.6% (45) and 8.8% (27) respectively (Table 4).

Of the total oxen examined 181 (58.8%) and 49 (15.9%) showed to have single and mixed infestations of ectoparasites (Table 5).

The monthly occurrence of different ectoparasites in oxen revealed significant ($P < 0.05$) difference between months in occurrence of ticks and mites whereas lice did not show to have any effect on months of their occurrence ($P > 0.05$) (Table 6).

Table 1: Endoparasites and their frequencies found in the faecal samles of oxen at Debre Zeit twon and its surrounding

		Number of animals			
			Infected		
Types of infection		Examined	With different spp	Total	Total with different spp
Single infection	*Strongyle* spp	308	70 (22.7)	108	82 (26.6)
	Eimeria spp	308	18 (5.8)		30 (9.7)
	Fasciola spp	308	16 (5.2)		16 (5.2)
	Paramphistomum spp	308	2 (0.6)		2 (0.6)
	Schistosoma spp	308	2 (0.6)		2 (0.6)
Mixed infection	*Strongyle* and *Eimeria* spp	308	12 (3.9)	12	
Total				120	

Table 2: Monthly prevalence of endoparasites in oxen at Dbre zeit twon and its surrounding

Endoparasites	Month	No. Examined	Positive (%)	c2	Significant
Strongyle spp.	October	40	22 (55)	52.24	P < 0.05
	November	83	33 (39.8)		
	December	64	9 (14.1)		
	January	71	12 (16.9)		
	February	50	6 (12)		
Eimeria spp	October	40	5 (12.5)	21.3	P < 0.05
	November	83	11(13.3)		
	December	64	11(17.2)		
	January	71	3 (4.2)		
	February	50	-		
Fasciola spp	October	40	6(15)	22.24	P < 0.05
	November	83	4(4.8)		
	December	64	4(6.3)		
	January	71	2(2.8)		
	February	50	-		
Schistosoma spp	January	71	1(1.4)	0.11	P>0.05
	February	50			
Paramphistomum spp	October	40	1(2.5)	0.46	P>0.05
	November	83			

Table 3: Prevalence of endoparasites in oxen of different age groups at Debre Zeit twon and its surrounding

Endoparasites	Age group of host animal (Year)	No. Examined	No. infected (%)	χ^2	Significant
Strongyle spp	3-5	108	37 (34.3)		
	5-10	200	45 (22.5)	4.38	P<0.05
Eimeria spp	3-5	108	22 (20.4)		
	5-10	200	8 (4)	19.56	P<0.05
Fasciola spp	3-5	108	4 (3.7)		
	5-10	200	12 (6)	0.36	P>0.05
Schistisoma spp	3-5	108	1 (0.9)		
	5-10	200	1 (0.5)	0.30	P>0.05
Paramphistomum spp	3-5	108	-		
	5-10	200	2 (1)	0.10	P>0.05

Table 4: Prevalence of different Ectoparasites in oxen in Debre Zeit twon and its surrounding

			Mixed infestation				
Ectoparasites	No. of animal Examined	Single infestation	Tick and mite	Tick and lice	Mite and lice	Tick, mite and lice	Total (%)
Tick	308	164	25	18	-	4	211 (68.5)
Mite	308	14	25	-	2	4	45(14.6)
Lice	308	3	-	18	2	4	27 (8.8)

Table 5: Prevalence of different species of ectoparasites of oxen in Debre Zeit town and its surrounding rural areas

			Number of animals infested	
Types of infestation		Examined	Infested with different parasites	Total (%)
Single Infestation	Tick	308	164	181(58.8)
	Mite	308	14	
	Lice	308	3	
Mixed infestation	Tick and mite	308	25	49(15.9)
	Tick and lice	308	18	
	Mite and lice	308	2	
	Tike lice and lice	308	4	
Total		308	230	230 (74.7)

Table 6: Monthly occurrence of ectoparasites in oxen at Debre Zeit twon and its surrounding

Ectoparasites	Month	No. Examined	No. infested (%)	c2	Significant
Tick	October	40	20 (50)	10.3	P < 0.05
	November	83	50 (60.2)		
	December	64	44 (68.8)		
	January	71	56 (78.9)		
	February	50	41 (82)		
Mite	October	40	4 (10)	21.3	P < 0.05
	November	83	21 (25.3)		
	December	64	4 (6.3)		
	January	71	8 (11.3)		
	February	50	8 (16)		
Lice	October	40	5 (12.5)	6.4	P > 0.05
	November	83	7 (8.4)		
	December	64	3 (4.7)		
	January	71	5 (7)		
	February	50	7 (14)		

Table 7: Prevalence of ectoparasites in oxen of different age groups at Debre Zeit twon and its surrounding

Ectoparasites	Age group of host animal (Year)	No. Examined	No. infested (%)	χ^2	Significant
Ticks	3-5	108	71(65.7)		
	5-10	200	140 (70)	0.41	P > 0.05
Mites	3-5	108	17 (15.7)		
	5-10	200	28 (14)	0.06	P > 0.05
Lice	3-5	108	11 (10.2)		
	5-10	200	16 (8)	0.19	P > 0.05

Table 8: Frequency of the different genera of ticks, mites and lice found in oxen at Debre Zeit twon and it's surrounding

Types of ectoparasites	Examined	Infested (%)
Tick genera		
Rhipicephalus	308	178 (57.8)
Ambylomma	308	56 (18.2)
Hyalomma	308	50 (16.2)
Total	308	284 (92.21)
Mite species		
Psoroptes ovies	308	42 (13.6)
Demodex bovies	308	3 (0.97)
Total	308	45 (14.6)
Lice species		
Linognathus vituli	308	27(8.8)
Haematopinus quadriperusus	308	1(0.3)
Total	308	28(9.1)

Table 9: Prevalence of mixed infestation with endo- and ectoparasites in oxen at Debre Zeit and its surrounding

Mixed infestation	No. animal examined	No. animal infected (%)
Strongyle and tick	308	48(14)
Strongyle and mange		2(0.6)
Strongyle and lice		1(0.3)
Strongyle, tick and mange		5(1.6)
Strongyle, tick and lice		9(2.9)
Eimeria and tick		17(5.5)
Eimeria and mange		1(0.3)
Fasciola and tick		2(0.6)
Fasciola and mange		1(0.3)
Fasciola, mange and lice		1(0.3)

Infestation with ectoparasites did not show any association with the age of host animals (p > 0.05) (Table 7).

Among the ectoparasites ticks were identified to the genus level. The tick genera identified include *Rhipicephalus* 178 (57.8%), *Ambylomma* 56 (18.2%) and *Hyalomma* 50 (16.2%). Of the mite species identified in 45 (14.6%) animals, *Psoroptes ovis* accounted for 42 (93.3%) followed by *Demodex bovis* 3 (6.7%) which was 13.6% and 0.9% respectively, of the total oxen examined. Two lice species identified were *Linognathus vituli* and *Haematopinus quadripertusus* with frequency of 27(8.8%) and 1(0.3%) respectively (Table 8).

Some of the oxen examined were found infested with both endo-and ectoparasites (Table 9).

DISCUSSION

The prevalence of endoparasitic infection (42.9%) observed in oxen at Debre Zeit twon and its surrounding rural areas revealed the importance of these parasites in oxen that could obviously result in reduced production and productivity. However, the rate of prevalence in the present study was lower than the reported prevalence of GI parasites (78.7%) in young cattle of Holeta [26] helminth parasites in dairy cattle (82.8%) of Holeta [17] in

adult cattle (81%) of Assela [15] and in adult cattle (54.4%) of Kelala, South Wollo [16]. The difference in the prevalence might be due to the difference in sample size, management system and climatic conditions of the areas and partly due to sex differences. The different types of helminth ova and oocysts of coccidia were also reported by Garber [13] in different parts of the country.

Ova of strongyle spp were observed in 26.6% of faecal samples examined. Mean while, the frequency was significantly higher ($P < 0.05$) in animals of age group 3-5 years (34.3%) as compared to animals of age group 5-10 years (22.5%) (Table 3). This can be attributed to an increase in the resistance of animals to parasite infection when they are exposed more to the parasites. Monthly prevalence of strongyle spp infection was also assessed and the result indicates significant ($P<0.05$) difference in infection between months being highest in October followed by November when compared to the other three months. This result revealed the association between strongyle spp infestation and seasons of the year. According to this study strongyle spp infestation decreased as the dry season of the year progressed.

Oocysts of *Eimeria* spp were obtained in 9.7% of faecal samples examined (Table1) and this frequency was lower than the finding of Faris [26] in young cattle of Holeta (66%). Study animals aged between 3-5 years were more affected (20.4%) than animals of 5-10 years (4%) (Table 3) and the difference was found statistically significant ($P<0.05$). This finding was in agreement with Sevensson [27] where young animals of 4 weeks age up to 2 years are more affected than older cattle. The possible reason for such difference in the prevalence of infection between the two age groups with this protozoal parasite may be due to decrease in the susceptibility of animals to such infection with an increase in age. Monthly prevalence of infection with these protozoal parasites showed significant ($P<0.05$) variation in infection between months being highest in December. This result suggests that *Eimeria* infection has association with seasons of the year.

Other endoparasite ova identified in the study area were ova of trematode with frequency of *Fasciola* (5.2%), *Paramphistomum* (0.6%) and *Schistosoma* spp (0.6%) (Table 1). This trematode infestation did not show any significant difference ($P<0.05$) in their occurrence between age groups of host animals. Neither they revealed any difference ($P<0.05$) between the months of the study period except for the Fasciola infestation ($P<0.05$). This finding might be due to extremely low occurrence of these spp of trematodes in the study area. The prevalence (6.4%) of trematodes in the study area was much lower compared to the report made by Etsehiwot [17] in dairy cattle of Holeta that indicted 80.6% infestation. This difference may arise from the difference in environmental conditions of the two localities and partly may be due to sex difference because female animals are more susceptible to endoparasites than males since they are exposed to physiological stresses.

This study revealed high prevalence (91.9%) of the major ectoparasites reported to be responsible for great economic losses in the study area. In the current study a total of 308 oxen were examined for the presence of ectoparasites of which 68.5% were positive for ticks, 14.6% for mites and 8.8% for lice. The prevalence of tick and mite infestation revealed significant ($P<0.05$) difference between the months of the study period whereas, lice infestation showed to have equal ($P<0.05$) incidence in all the months.

The frequency of animals infested by ticks increase as the dry season progressed. This study did not agree with studies made by Surafel [28] in Northern Ethiopia and Ataklty [29] in and around Mekelle. The two studies suggested that tick infestations would increase in wet seasons and with a tendency to decrease in dry seasons of the year. The possible reason for this could be difference in climatic condition of the areas. However, a survey in this study area in wet season and comparison with the result of the present study can only reveal the fact. The overall prevalence of tick infestation in oxen was 68.5% with 57.8%, 18.2% and 16.2% recorded for the genus *Rhipicephalus*,, *Amblyomma* and *Haylomma* respectively.

There was no difference ($P<0.05$) between the age groups of animals regarding ectoparasite infestation. This study showed that young and adult oxen of any age group can equally be infested by ticks if the climatic condition of the area and management system under which animals kept is similar.

Among the identified tick genera, *Rhipicephalus* was the most prevalent (38.3%) and this study was in agreement with the study conducted in some selected areas of eastern Shoa by Amanuael [30]. This tick genera was also reported by Morel and Rodhain [31], Mehari [32] and Sebsibe [33] from different localities in southern Ethiopia; Surafel [28] and Ataklty [29] in northern Ethiopia; Behaliu [34] in Arsi zone. This tick genus is found widely distributed throughout Ethiopia and Feseha [35] stated that *Rhipicephalus* showed no preference for a particular altitude or rainfall zones or seasons, which supports the present finding.

Other tick genera identified from the study area were *Amblyomma* (18.2%) and *Haylomma* (16.2%). *Amblyomma* was reported by Morel and Rodhain [31] and Sebsibe [33] from Southern Ethiopia, Belete [4] and Tedla [40] from eastern Harrarge, Behaliu [34] from Arsi zone and Ataklty [29] from Northern Ethiopia and Endale [38] from Ambo. The results of this study are in agreement with reports of the previous workers. According to Feseha [35], ticks were dispersed in all regions of Ethiopia. Massive presence has been recorded in Jibat and Mecha (Eastern Oromia), Wollega administrative region (Western Oromia) and in the Shire lowlands of Tigray. Abundance was found to be much lower in tropical woodland and thorn bush vegetation habitats in the rift valley and some was found in arid south eastern areas. Ticks are known to directly affect the quality of hides and increase the susceptibility of animals to skin diseases indirectly by enhancing the spread and/or establishing of other skin diseases.

Two species of mites identified in the study area were *Psoroptes ovis* and *Demodex bovis* infesting 13.6% and 0.97% of total animals examined. The overall prevalence of lice infestation in this study was 8.8%, the main louse species identified was *Linognathus vituli* accounting for 8.5% of total animal examined. This genus of louse was also reported by Faris [26] in Holeta and Ataklty [29] in Mekelle and its surrounding and this study is in agreement with the previous workers. Heavy infestation of sucking lice can cause severe anemia while both sucking and biting lice are a source of irritation and skin damage which may lead to a loss of production and damage of hides [22].

In this study, 46.4% of oxen were found to be infected with two or more of the parasites. This mixed infestation (Polyparasitism) may result in hampering of the productivity and performance of oxen in the study area by causing decrement in body condition, anaemia, dehydration and result in reduction of the benefit obtained from these animals. This study revealed that the study area has suitable environmental conditions for survival and transmission of these identified parasites. Furthermore, absence of regular follow up, anthelmentic and acaricide treatment of oxen has contributed for such high frequency of endo-and ectoparasitism.

CONCLUSION

The overall high prevalence of endo/ectoparasites obtained in oxen of Debre Zeit town and its surrounding areas indicated the importance of the problem and its contribution to hampering the productivity, work performance and general health status of these animals. The predominant endoparasites identified were *Strongyle*, *Eimeria* and to less extent *Fasciola* spp. Although at a very low prevalence, infection of oxen with *Paramphistomum* spp and *Schistosoma* spp were also encountered. Due to the mixed nature of infestation of hosts by these parasites their role in reducing the productivity and the general health status cannot be under-estimated. In addition to endoparasites, infestation by ectoparasites such as ticks, mites and lice can also worsen the general health status of these animals in the study area. These all indicate that Debre Zeit town and its surrounding areas are favorable for the successive perpetuation of the mentioned parasites and for their subsequent transmission to susceptible host. Therefore, a strategic antehelmintic and acaricide treatment should be adopted and extended to farmers taking in to account the specific situation of each agro-ecology; farmers have to be educated about the impact of endo and ectoparasitism on the health and productivity of animals as to implement participatory approach in the control of parasitism; the role of veterinarian in giving professional advice regarding preventive and control measures against both endo and ectoparasites should be enhanced and further epidemiological studies should be conducted in different agro-ecological sites in the country.

ACKNOWLEDGEMENT

The authors would like to thank Addis Ababa University and the staff of Parasitology Laboratory, Faculty of Veterinary Medicine, Addis Ababa University for their provision of laboratory equipments/materials, chemicals and technical support during sample processing.

REFERENCES

1. CSA, 2004. Ethiopia Agricultural sample enumeration results for NNRR, statistical report on livestock and farm implements, part IV, 29-30pp.
2. Ahmed, M., 2001. Raw hides and skin improvement in Ethiopia. A paper presented on “technical workshop on good practice for the Ethiopian hides and skin industry. Imerial Hotel conference Hall, Addis Ababa, Ethiopia, Dec 4-7/2001.
3. Grisar, L. and E. Volkmann, 2000. The prevalence of DAD the case of Ethiopia, study project, Humboldt University of Berlin, pp: 49-52.

4. Belete, M., 1987. Preliminary survey of ticks on four species of domestic animals in Nekemte Awraja, DVM thesis, FVM, AAU, Debre Zeit, Ethiopia.
5. Fall, A., R.A. Person, P.R. Laurence and S. Fernandez Rivera, 1997. Feeding and working strategies for oxen used for draft purposes in semi-arid West Africa. ILRI, Nairobi, Keneya, pp: 1-3.
6. Jahnke, H.E., 1982. Livestock production system and Livestock development in Africa. Kieler wissennchafsuerlag vauk, Federal Republic of Germany, pp: 253.
7. Sehwartz, H.J. and M. Doli, 1995. potentional and limitations of Biotechnology in livestock production in developing countries. Biotechnology for the improvement of animal nutrition and Health, part II, pp: 19-20.
8. Aiello, S.E. and A. Mays, 1998. Coccidiosis of oxen In: The Merck vetrrinary manual, 8th ed., Merck and co., INC, white house USA, pp: 143-144.
9. Eysker, M. and H.W. Ploeger, 2000. Value of present diagnostic methods for GI nematode infection in ruminants, Division of parasitology and Tropical veterinary medicine Utrecht University, The Netherlands, pp: 109-116.
10. Tizard, I.B., 1996. Veterinary Immunology. An Introduction Immune response of new borne animals, 5th ed., Department of pathology, the Texas veterinary medicine center Texas A and M University, college station, Texas., pp: 241-250.
11. Nesru, H.M., 1997. Study on calf mortality of Adamitulu livestock research center. In proceedings of the 5th conference of ESAP (Ethiopia society of animal Production), Addis Ababa, Ethiopia, pp: 57-162.
12. Mckenna, P.B., 1983. Parasitic causes of diarrhea in young oxen preceding of a course in dairy oxen medicine, Massey University.
13. Graber, M., 1975. Helminths and Helminthiasis of domestic and wild animal in Ethiopia, Vol. 1, Ministry of Agriculture, Addis Ababa, Ethiopia, pp: 82-90.
14. Ademe, Z., 1985. Importance of helminthiasis in the Cheffa dairy farms, south Wollo. DVM thesis, FVM, AAU, Debre Zeit Ethiopia.
15. Zerfu, M., 1991. Prevalence of GIT helminthes of oxen in Chilalo Awraja, Arsi Administration. DVM, thesis, FVM, AAU, Debre Zeit, Ethiopia.
16. Tesfaye, H., 1998. Prevalence of GIT helminthes of oxen in Kelala, South Wollo In: proceedings of EVA conference, 1998, Addis Ababa, Ethiopia, pp: 30.
17. Etsehiwot, W., 2004. A study on Bovine Gastro intestinal Helminthes in Dairy cow in and around Holeta. DVM, thesis, FVM, AAU, Debre Zeit, Ethiopia.
18. Solomon, G., M. Nigist and B. Kassa, 2003. Seasonal variation of ticks of calves a Sebeta in Western Shoa Zone, Ethiopia. Ethiopian Veterinary Journal, 7 (1 and 2), 17-32 pp.
19. NMSA, 1999. Rainfall and temperature data of Debre Zeit, National Meterological service Agency, Addis Ababa, Ethiopia.
20. Zeleke, A., T. Bizuneh and T. Tesema, 2005. Historical milestones of Debre Zeit Agricultural Research center, DARC in half a century (1995-2005) Bulletin of Golden Jubille, pp: 5.
21. De-Launta, A. and R.E. Habel, 1986. Teeth, Applied veterinary Anatomy, W.B. Sounders Company, pp: 4-16.
22. Urguhart, G.M., J. Armour, J.L. Duncan, A.M. Duan and F.W. Jennings, 1996. Veterinary parasitology, 2nd. Black well science Ltd. London, UK., pp: 229-301.
23. Sloss, M.W., R.L. Kemp and A.M. Zajac, 1994. Veterinary clinical parasitology, 6th ed., Iowa state university press, A Blackwell publishing company, USA., pp: 8-13.
24. Soulsby, E.J.L., 1986. Helminths, Arthropodas and Protozoa of Domestic animals, 7th ed., Baiilier Tindal, 136-146.
25. Agrawa, B.L., 1996. Basic statistics, 3rd ed., new age int 1 (P) limited publisher, new Delhi, India, pp: 215-232.
26. Faris, D., 2005. A study on endo and ecto parasites of young oxen in Holeta and its surroundings, DVM thesis, FVM, AAU, Debre Zeit, Ethiopia.
27. Svensson, C., 1993. Perpartal excretion of Eimeria oocysts by cows on Swedish dairy farms and the age of calves at first excretion. Acta Veterinaria Scandinavica, 35(3): 77-81.
28. Surafel, M., 1996. Survey on tick species in four domestic animals in Tigray region. DVM, thesis, FVM, AAU, Debre Zeit, Ethiopia.
29. Ataklty, H., 2007. prevalence of Bovine Ectoparasite in and around Mekelle. DVM thesis, FVM, AAU, Debre Zeit, Ethiopia.
30. Amanuel, K., 1992. Ectoparasites and associated skin diseases of oxen in some selected areas of Eastern Shoa, DVM thesis, FVM, AAU, Debre Zeit, Ethiopia.
31. Morel, P. and F. Rodhain, 1972. Contribution a la connaisonce destgues due suddela Ethiopia, Bulietin dela socite de pathologic exotique, 65(5): 725-732.

32. Mehari, B., 2004. Distribution of livestock tick species in Awassa area. DVM thesis, FVM, AAU, Deber Zeit, Ethiopia.
33. Sebsibe, B., 1988. A preliminary survey of tick distribution in southern Sidamo, DVM, thesis, FVM, AAU, Debre Zeit, Ethiopia.
34. Behailu, A., 2004. A study of ticks and tick borne protozoans in oxen at Assela, Arsi Zone, DVM thesis, FVM, AAU, Debre Zeit, Ethiopia.
35. Feseha, G., 1983. Notes on tick species and tick borne diseases of domestic animals in Ethiopia, FVM, AAU, Debre Zeit, Ethiopia.
36. Morel, P., 1980. Study on Ethiopian ticks (Acarida, Ixodida), Republic of France, Ministry of foreign Affairs, French Vet. Mission, Addis, C. J. E. M. V. T., pp: 7-332.
37. Teshome, Y., 1985. Oxen tick resistance against acaricides in the institute of Agricultural research at Bako. DVM thesis, FVM, AAU, Debre Zeit, Ethiopia.
38. Mekonnen, S., I. Hussein and B. Bedne, 2001. The distribution of Ixodid ticks in centeral Ethiopia. On derstepoort, J. Vet. Res., 68(4): 243-251.
39. Endale, B., 2006. A survey on ticks of oxen in Ambo area, west Ethiopia. DVM thesis, FVM, AAU, Debre Zeit Ethiopia.
40. Tedla, H., 1991. Identification of tick species and distribution in oxen, camels, sheep and goats in eastern Harrarge. DVM thesis, FVM, AAU, Debre Zeit, Ethiopia.